For drilled shafts, geotechnical axial ultimate side resistance is determined in both the soil and in weathered rock. Side and toe resistance in soil profiles are estimated using the procedures outlined in Section 10 of AASHTO (2006) for cohesive or cohesionless soils. These methods are similar to those found in O'Neill and Reese (1999). In weathered rock strata, ultimate side resistance is often assumed to be between 4 and 8 kips/ft^2 while ultimate toe resistance is assumed between 90 and 120 kips/ft^2. These values come from a combination of the experience of the designer and knowledge of the formation from which the weathered rock was produced. These values have been verified in the past by NCDOT and others using field load tests.

Geotechnical lateral resistance is determined using P-y analyses, such as those found in LPILE (Ensoft, 2004), or MultiPier. Design for soil strata is the same as for pile bents. In weathered rock, based on the work of Gabr et al. (2002) in a project funded by NCDOT, the weathered rock is modeled using a stiff clay model with elevated strength properties, or a weak rock model with low unconfined compressive strength values for the rock. In crystalline rock, a Vuggy limestone model with unconfined compressive stresses in the range of 3 kips/in^2 is used These P-y models are selected, in part, based on pragmatism: they are available in LPILE, which is the DOT's current single pile lateral analysis program. Once the drilled shaft is sized based on lateral capacity considerations, the geotechnical unit determines a point of fixity, which is transmitted to the Structures unit along with the Geotechnical unit's other recommendations.

Structural Design

Structural design of drilled shaft bents is similar to those used for pile bent design. Currently, the frame analysis program used is Georgia Pier, although the need to adopt LRFD based design has caused the consideration of RC-Pier (LEAP Software, 2006). The latter program generates live loads due to an AASHTO truck loading on the bridge as a part of the software suite; in Georgia Pier this was done separately. The live and dead loads from the superstructure design and the extreme event loading from wind, stream pressure, vessel impact, and others are then entered into the program to generate the loads in the bent cap and the individual piles. Once the demand on the structural